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AVERAGE PRESSURES FOR OCEANIC AREAS COMPUTED FROM DAILY SYNOPTIC CHARTS

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The relation of the weather on the North American Continent to the pressure situation over the North Pacific Ocean has long been recognized by meteorologists. The bearing of the position of the subpermanent Aleutian low on the movement of the cyclones on the continent has been stressed by Bowie and Weightman, in "Types of Storms in the United States and Their Average Movements," page 4, while the aspect of the North Pacific anticyclone has been variously recognized and discussed. Specific allusion to the influence of the latter is made in a recent issue of the *Monthly Weather Review*¹ by Blochman, Henry, and McEwen. Henry's reference to the high-pressure phenomenon in the North Pacific as a "statistical anticyclone" is an excellent denomination, since its fixedness in the middle latitudes of the eastern Pacific clearly distinguishes it from the migratory type. Naturally these two complementary wind systems, the high in the south and the low in the north, are closely watched by weather forecasters on the Pacific slope, who make a constant study of their movements.

During recent years this practice has been facilitated by the accumulation of observational data by radio from ships traversing the Pacific Ocean, and at the present time reports of this character are normally numerous enough to permit the preparation of fairly complete daily weather charts for the eastern North Pacific Ocean. Much information is therefore being acquired of facts which before were either unrecognized or else only conjectured. For example, it would be natural to suppose that the configuration of isobars delimiting a cyclonic circulation would be much more symmetrical over a large and thermally homogeneous water surface than over continental areas of rugged relief and more or less local contrasts of temperature and humidity. Experience in the day to day preparation of the ocean charts above referred to has not only confirmed this belief, but has demonstrated its applicability to the hitherto somewhat problematical pursuit of information regarding average atmospheric pressure over the oceanic areas in general and also for any desired positions therein. It would be quite impossible to chart the pressure over a land area the size of the United States or even one-tenth of that area from data as scanty as those ordinarily available for a corresponding area of the Pacific Ocean. Yet it seems reasonably certain that the isobaric charts which have been constructed at San Francisco have represented, at least for the last year or more, a fairly accurate delineation of the surface pressure north of the thirtieth parallel and east of the one hundred and eightieth meridian.

It is true that for large parts, especially the central part, of this area data are frequently lacking or altogether absent. In such cases the isobars have been interpolated and the charts completed on the inference that certain observed developments have continued or that a previously observed situation continued to obtain, the pressure gradients being determined under the assumption, as stated above, that the configuration of isobars should normally be to a great extent free from the distortion imposed upon them by artificial or continental conditions. Many times, after this has been done and the charts completed, belated reports have been received from some ships traversing the region for which data had been wanting, and these reports have corroborated the disposition of the isobars already plotted, to a degree which required no material change therein.

An obvious derivative of this system would be its application to a statistical method of obtaining pressure averages over the ocean as a whole from quantitatively similar data. Thus, if the mean pressure for the month were desired for a certain intersection of parallels and meridians in the eastern Pacific Ocean for which not a fragment of direct information existed in the form of vessel weather reports, it would be entirely possible to compute it by scaling off from the isobaric charts the day-to-day pressures at points in the particular sector for which means were desired and taking the average of these. This is the actual practice at the San Francisco office of the Weather Bureau in the preparation of the daily charts showing pressure variations over the Pacific Ocean; the only difference being that, instead of mean pressure, the object sought is the daily variation in pressure at established points throughout the region affected. This method has been employed for more than a year, and has demonstrated its feasibility for this particular purpose. It has been tested for the purpose of this paper from another angle with interesting and encouraging results, namely, to depict the average position and intensity of the subpermanent low and high pressure areas of the eastern North Pacific Ocean during two consecutive periods when their characteristics as to position, size, and intensity displayed significant and extraordinary contrasts.

The periods selected comprise the respective groups of days from January 1 to 24, 1926, inclusive, and January 25 to February 3, 1926, inclusive. Mean pressures for the ocean area have been computed from daily interpolated values as obtained from the p. m. isobaric charts, computations being made for the intersections of parallels of latitude and meridians of longitude at intervals of 10°. Smaller intervals could have been taken, and are in fact employed for preparation of the daily pressure

¹ *Monthly Weather Review*, vol. 53, No. 11, pp. 483-494.

variation charts where it is desired to observe day-to-day fluctuations over small areas; but for obtaining mean values over the ocean as a whole, and for more or less extended periods, data for smaller geographical intervals would serve little purpose, due to the remarkable symmetry of the mean isobaric surfaces. The p. m. charts were chosen for this study as they include data for the Island of Midway, whereas the a. m. charts do not. Mean pressures were therefore available for this station as well as for Honolulu and for coastal stations from the Aleutians to San Diego.

The two charts need little comment; the most casual inspection will reveal conspicuous differences. The first one (fig. 1) comprising the period January 1 to 24, depicts practically normal conditions for January as regards pressure distribution. It conforms strikingly to the well-known mean January pressures as given by the

States, except for a rainless period from the 6th to the 13th, rain fell with about the usual regularity for the season. In other words, the individual lows, bred within the subpermanent low-pressure system to the westward, pursued their normal course along the northerly route, migrating around the northern periphery of the Pacific HIGH and leaving California untouched. Following the disappearance of the Pacific HIGH and the alteration in the direction of the major axis of the Aleutian low-pressure system came a change to wet weather in California. The realignment of the oceanic pressure system was first noticeable on the chart of January 25. It was well confirmed by the chart of January 26, so much so that a statement was incorporated in the official weather synopsis of that date to the effect that general rains would occur in the Pacific States "during the latter part of the current week,"

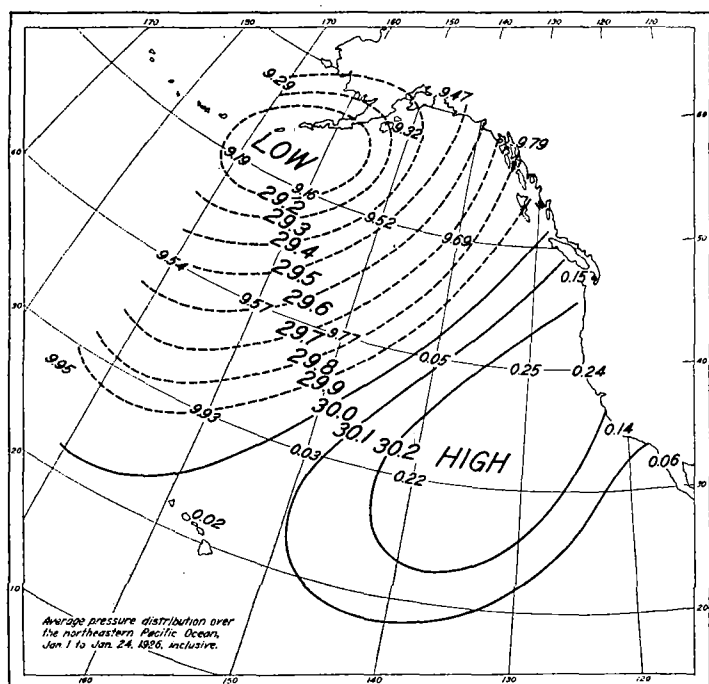


FIG. 1

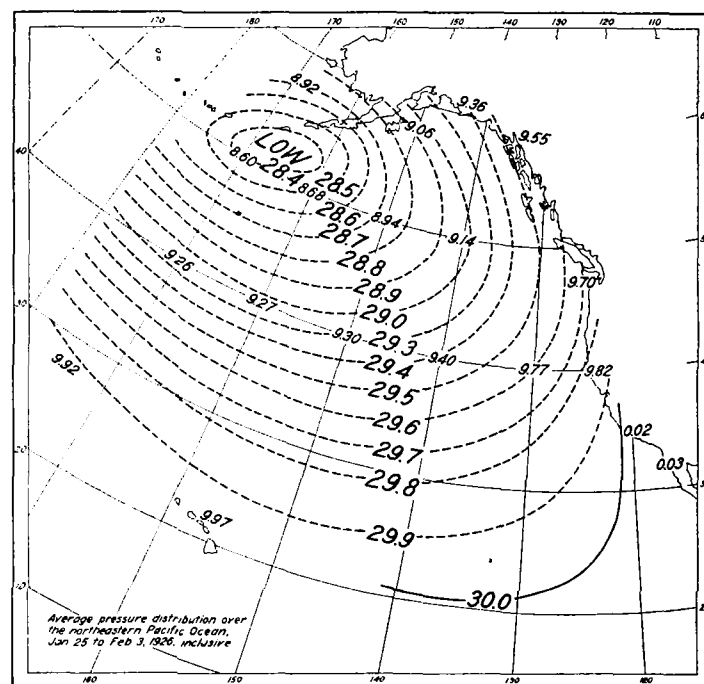


FIG. 2

Pilot Charts of the Hydrographic Office, the main departures being simply in the somewhat accentuated depth of the Aleutian Low during the period under review. The relative positions of the HIGH and the LOW, however, approximate the normal, and the directions of their major axes are the usual ones. In Figure 2, which embraces the subsequent period January 25 to February 3, inclusive, the North Pacific HIGH has disappeared entirely, the major axis of the Aleutian low has swung through an angle of 90° and lies along a line drawn almost directly through northwest-southeast, while the mean pressure at the center has dropped from 29.20 inches to 28.40 inches.

Naturally such radical alteration in the pressure régime over the ocean could not fail to be reflected by correspondingly contrasted weather conditions on the Pacific slope as between the two periods involved. During the earlier period drought prevailed in California and rain occurred only on two occasions, when it was brief and insufficient, whilst in the Pacific Northwestern

viz, January 28 to 30. As a matter of record, rain set in on the northern California coast January 28, covering the entire State with copious precipitation by the 31st, and continuing at intervals as supplied by successive cyclones, until February 5, when a reversion to the ordinary type as depicted in Figure 1, took place, and rains in California ceased.

As the object of this paper is to bring out the possibilities of pressure summaries over oceanic areas from which reports are sporadic and badly distributed, and not to discuss in particular the peculiarities of weather resulting from a given pressure distribution, further mention of the stormy period need not be made, beyond remarking that the interval of subnormal rainfall in California which was terminated on January 28, while not perhaps unprecedented, had reached a point which threatened serious economic disasters. The circumstances attendant upon its end are consequently of more than ordinary interest both to the public at large and to the investigator of climatic phenomena.